Trans-Lithospheric Diapirism as a Possible Mechanism for Ophiolite Emplacement?

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[ДР РГФ]

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10.5194/egusphere-egu24-568

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Introduction

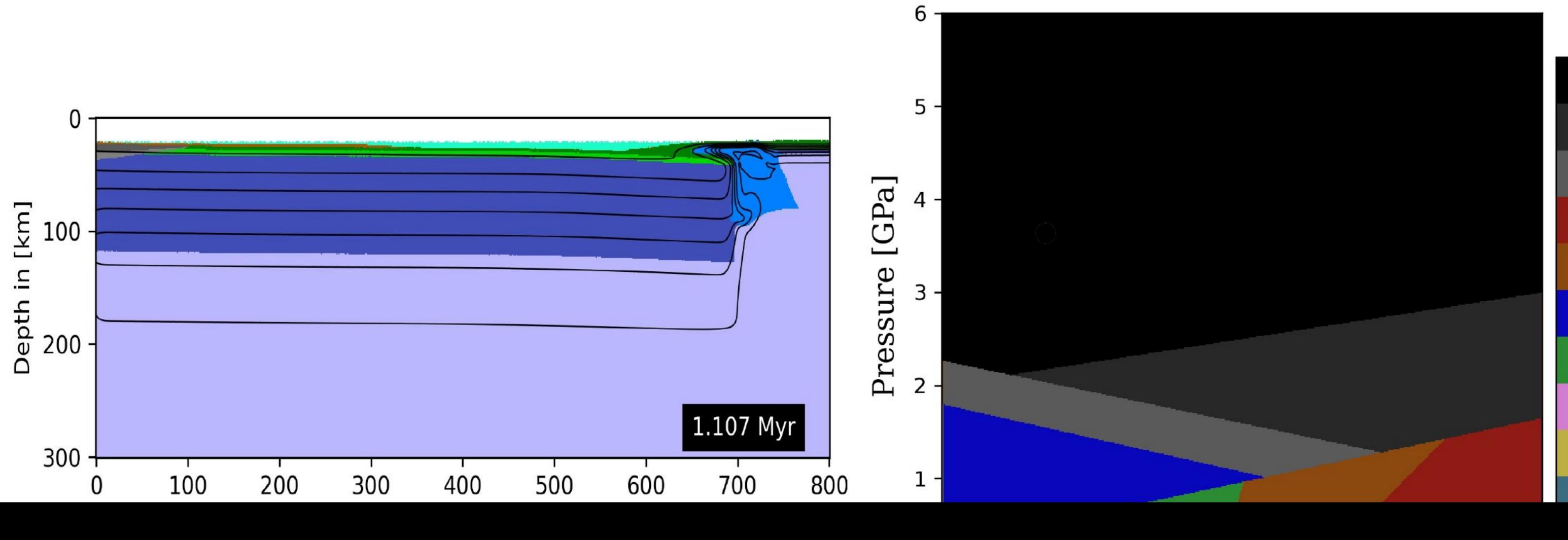
Oceanic obduction and ophiolite emplacement represent processes that result in Retreating intra-oceanic subduction is initiated spontaneously at a transform fault (sensu [5], Fig. 1) located positioning of more dense oceanic lithosphere on top of less dense continental crust. some 600 km from the passive continental margin. The older and more dense left slab subducts and retreats While obduction is known to be related with the processes of oceanic closure, exact towards the continent. This is accompanied by asthenospheric upward flow that results in generation of a new mechanisms of the permanent emplacement of ophiolites are still controversial. young lithosphere in the volcanic arc region. This mode develops spontaneously for 5 Myr until the trench 50 -Moreover, this proved to be a rather difficult process to model numerically. Some reaches the continental margin followed by the onset of continental subduction (Fig. 3). The continental notable successes were achieved in the last decade. Firstly, by utilizing reversal of subduction is regulated by significant slab pull of the old slab and the presence of a very young and thin convergence rate of plates [1] succeeded in permanently emplacing significant portions overriding lithosphere. As the continental crust descends deep into mantle, reaching depths of up to 300 km, **100** of obducted oceanic lithosphere. More recently [2] showed that far-traveled ophiolites most rocks reach P-T conditions corresponding to high pressure eclogite facies, while many reach even UHP can be accounted for by triggering the continental extrusion mechanism. Here we conditions (Fig. 4,5). Crustal rocks become rheologically activated. They decouple from the rest of lithosphere present our ongoing research on an another possible mechanism that could emplace and migrate vertically upward. The crust first starts the process of underplating beneath the thin lithosphere. 150 ophiolites, namely trans-lithospheric diapirism of the subducted continental crust. We This is then followed by upward piercing and detachment of the obducted oceanic lithosphere from the rest of follow the the similar approach of activating the continental crust at high P-T conditions the onset of the simulation, a significant portion of the young oceanic ____ in order to sever the obducted oceanic lithosphere. However, we try to do so not by lithosphere is located on top of the continental crust, separated from the remains of the overriding plate by a [km] triggering continental extrusion but rather investigating if trans-lithospheric diapirism new highly metamorphic complex of recycled crustal rocks. In the terminal phases of the simulation, the could lead to a similar result. The process of trans-lithospheric diapirism of the subducted oceanic slab undergoes detachment. This occurs at the depth of around 250 km and results in continental crust was recently modelled [3] in the context of continental collision and subsequent uplift of the remaining mantle lithosphere, thus permanently emplacing the obducted ophiolite formation of European Variscides. We try to develop a similar mechanism in the context rocks. A new passive margin is formed some 200 km away from the old one (Fig. 6). It should be noted that in of retreating intra-oceanic subduction (Fig. 1) that reaches the continental margin and melt extraction were neglected. These processes might significantly alter the triggers continental subduction. course of development of the ophiolite emplacement.

Methods

For the purposes of simulating the geodynamic processes in this research, we use thermo-mechanical system. These consist of the Continuity equation, Stokes equations in x and y directions as well as the Temperature equation:

$$\frac{\partial v_x}{\partial x} + \frac{\partial v_y}{\partial y} = 0 \qquad \frac{\partial \sigma'_{ii}}{\partial x_i} + \frac{\partial \sigma'_{ij}}{\partial x_i} - \frac{\partial P}{\partial x_i} = -\rho g_i \qquad \rho C_P \frac{DT}{Dt} = -\frac{\partial q_x}{\partial x} - \frac{\partial P}{\partial x_i}$$

where v is velocity, σ ' deviatoric stress tensor, ρ density, g gravitational acceleration, T temperature, P pressure, Cp heat capacity and q heat flux, while H accounts for $\frac{1}{2}$ 200 different heat sources; i and j represent coordinate indices. To solve these equations \Box geodynamic numerical code I2VIS is employed [4]. The code is based on conservative finite-differences formulation of the geodynamic equations combined with marker-incell approach. Advection is solved by moving the markers according to the velocity field via utilizing a fourth-order Runge-Kutta advection schemes.



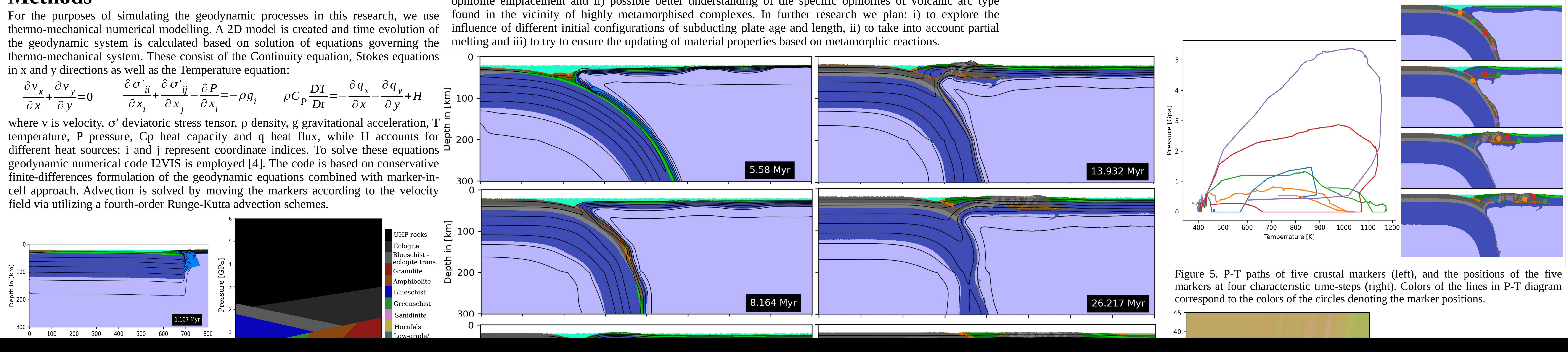


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Results and Discussion

HP rocks logite trans.

Implications of the result of this modelling include: i) proposition of another theoretical mechanism for ophiolite emplacement and ii) possible better understanding of the specific ophiolites of volcanic arc type







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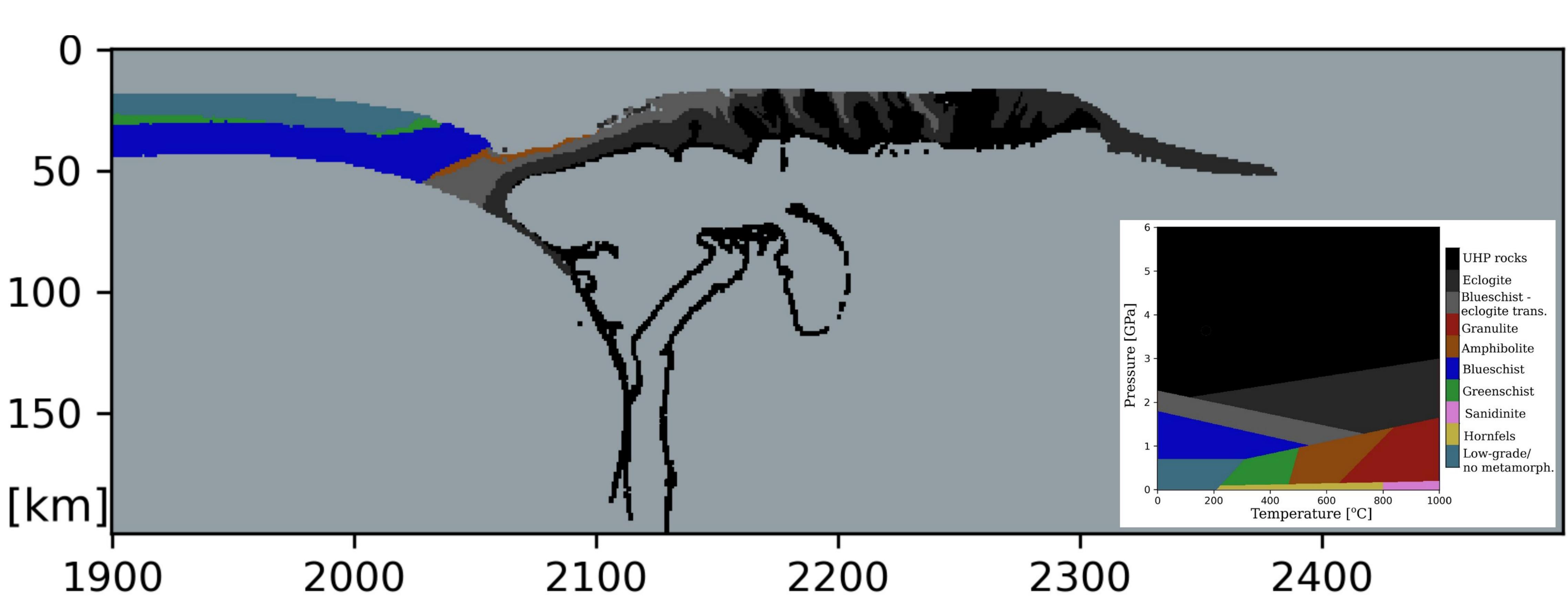


Figure 4. Spatial distribution of estimated peak metamorphic facies of a section of continental crustal rocks after 39 Myrs. This time corresponds to the period after most of the subducted continental crust had already reached the surface. Colors represent different metamorphic facies as designated on Fig. 2 (included here on the bottom-right for brevity).